

Particulate Matter Concentrations in Dense Urban Zones of General A. Yani Street, Palembang City

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ABSTRACT

This study aims to measure and analyze PM_{2.5} and PM₁₀ concentrations along Jalan Jenderal A. Yani, Palembang, and assess the impact of humidity, temperature, and wind speed on particulate concentrations. Measurements were taken at five observation points during three time periods: morning, afternoon, and evening. The results showed that PM_{2.5} and PM₁₀ concentrations exceeded safe thresholds at certain times. High PM_{2.5} concentrations were mainly observed in the morning and evening, while high PM₁₀ concentrations in the morning were attributed to increased traffic activity. Wind speed showed a significant positive correlation with both types of particles. The findings emphasize the importance of continuous monitoring and targeted interventions to reduce health risks associated with air pollution in urban environments. This study provides valuable insights for policymakers to develop strategies to mitigate particulate pollution and improve public health outcomes

INTRODUCTION

Air pollution is one of the world's most serious environmental problems, especially in developing countries. Air pollution can come from a variety of sources, including natural processes such as volcanic eruptions, forest fires, and biotic decay, as well as anthropogenic sources such as industry, transportation, and waste burning (US-EPA, 2019). Particulate Matter (PM) is one of the most important indicators of air pollution, as it can cause a variety of health problems, including respiratory disorders, heart disease, and even death (WHO, 2018).

One of the measures of air pollution based on the Government Regulation of the Republic of Indonesia No. 41 of 1999 concerning air pollution is particulate matter (PM) or particulate dust which is distinguished by its size, namely PM_{2.5} and PM₁₀. Therefore, air quality measurements with Particulate Matter indicators with sizes less than or equal to 2.5 microns (PM_{2.5}) and 10 microns (PM₁₀) are carried out to see the air quality in a place. PM_{2.5} levels are categorized as safe according to the Permenkes is less than 35 µg/m³ while PM₁₀ levels are less than <70 µg/m³.

There are various sources of Particulate Matter (PM), the first source of PM from nature in the form of material from volcanoes, dry soil dust, and volcanic ash. While the source of PM due to human actions is mostly derived from coal combustion, industrial processes, forest fires, and transportation equipment exhaust gases (Pultri, 2017).

The existence of transportation has an important role as a source or contributor to air pollution that occurs to date up to 70% of total air pollution due to incomplete combustion of fuel in vehicle engines (Yusrianti, 2015). Furthermore, Martuti (2013) said that the increase in the number of motorized vehicles has the potential to increase air pollution, especially on protocol roads. The increase in activity on Jalan A. Yani, Seberang Ulu II Sub-district, has a fairly dense mobility with the presence of modern shopping centers and four universities. Based on the ratio of vehicle volume to road capacity (VCR = volume capacity ratio) in Seberang Ulu II Subdistrict, Palembang City reached 9.433 (smp / hour), including areas in Palembang City with the highest VCR level (Palembang City Government, 2020).

PM air pollution has a negative impact on respiratory health. Azizah (2019) found that particulate matter concentrations of PM_{2.5} and PM₁₀ in Jakarta City exceeded the safe threshold and had a significant association with respiratory disorders. Kurniawan (2019) also found that particulate matter is one of the pollutants that is often used as an indicator of air pollution to show the level of danger to the environment and to health. Another study by Waqi et al. (2023) found that there was a significant relationship between impaired lung function and intake that exceeded the reference dose.

In addition, several other studies have also proven that PM air pollution has a negative impact on respiratory health, such as Chen et al. (2022), Huang et al. (2022), Kumar et al. (2022), Li et al. (2022), Liu et al. (2022), and Rai et al. (2022). These studies show that PM_{2.5} and PM₁₀ particulate matter concentrations in various cities around the world exceed safe thresholds and have a significant association with respiratory disorders.

Previous studies have shown that air pollution in Palembang City has a negative impact on public health (Sembiring, 2017; Azizah, 2019). However, there has been no research that specifically investigates the concentration of PM_{2.5} and PM₁₀ particulates in Jalan Jenderal A. Yani, Palembang City. Research on PM_{2.5} and PM₁₀ particulate concentrations in Palembang City has been conducted by several researchers, but there are still some shortcomings and gaps in the research. Previous studies only focused on PM₁₀ particulate concentrations, while this study also considered PM_{2.5} particulate concentrations (Wijayanti, 2015). This study also considered other factors such as wind speed and humidity (Rai et al., 2017). There have not been many recent studies on PM_{2.5} and PM₁₀ particulate concentrations in Palembang City, so this study can be considered as one of the latest studies in this field (Liu et al., 2020).

Although extensive research on the impact of air pollution on respiratory health has been conducted, more localized studies focusing on the specific impacts of particulates (PM_{2.5} and PM₁₀) in urban areas with heavy traffic, such as provincial capitals, are needed. In particular, data on the correlation between PM levels and respiratory health outcomes in densely populated commercial and educational zones, such as on Jalan Jenderal A. Yani, Seberang Ulu II Sub-district, Palembang City, South Sumatra Province, still need to be expanded. To address these gaps, it is critical to develop targeted interventions and policies to reduce air pollution and its impact on health in similar urban environments.

This study aims to measure and analyze the concentrations of particulate matter PM_{2.5} and PM₁₀ at Jalan Jenderal A. Yani, Seberang Ulu II Sub-district, Palembang City, South Sumatra Province, and evaluate whether these concentrations exceed the hazardous limits as set by health standards. In addition, this study also aims to assess the impact of meteorological parameters such as humidity, temperature, and wind speed on PM_{2.5} and PM₁₀ concentrations. By comparing observed data with established thresholds and drawing correlations from existing literature, this study seeks to provide insights into the potential health risks associated with air pollution in these urban environments and to inform targeted intervention and policy recommendations.

LITERATURE REVIEW

Particulate matter (PM) pollution is a significant environmental issue in urban areas, posing serious health risks to residents. Studies have shown that exposure to PM can lead to respiratory problems, cardiovascular disease, and even premature death (Pope & Dockery, 2006).

Urban areas with high population density and traffic activity tend to have higher PM concentrations. A study in Beijing, China found that PM_{2.5} concentrations were significantly higher in areas with high traffic density (Wang et al., 2015).

In Indonesia, urban air pollution is a growing concern, particularly in cities like Palembang. A study in Jakarta found that PM₁₀ concentrations exceeded national ambient air quality standards (Santoso et al., 2013).

General A. Yani Street in Palembang City is a densely populated urban area with high traffic activity. The street is a major transportation hub, with thousands of vehicles passing through every day. Previous studies have shown that PM

concentrations can vary significantly depending on location, time of day, and weather conditions. A study in Hong Kong found that PM_{2.5} concentrations were higher in areas with high-rise buildings and narrow streets (Shi et al., 2016).

Meteorological factors such as temperature, humidity, and wind speed can also impact PM concentrations. A study in Seoul, South Korea found that wind speed was a significant predictor of PM₁₀ concentrations (Kim et al., 2017). In addition to traffic activity, other sources of PM in urban areas include industrial emissions, construction activities, and waste burning. A study in India found that industrial emissions were a significant contributor to PM pollution in urban areas (Guttikunda et al., 2014).

The health impacts of PM pollution can be significant, particularly for vulnerable populations such as children and the elderly. A study in the United States found that exposure to PM_{2.5} was associated with increased hospital admissions for respiratory problems (Zanobetti et al., 2009). Reducing PM pollution in urban areas requires a multi-faceted approach, including emission controls, public education, and policy interventions. A study in London found that congestion charging schemes can be effective in reducing PM pollution (Beever et al., 2012).

In Palembang City, reducing PM pollution will require a coordinated effort from government agencies, private sector stakeholders, and residents. A study in Singapore found that public education campaigns can be effective in raising awareness about air pollution (Tan et al., 2017).

The impact of PM pollution on public health in Palembang City is likely to be significant, given the high population density and traffic activity in the area. A study in Brazil found that PM pollution was associated with increased mortality rates in urban areas (Sousa et al., 2012).

Further research is needed to better understand the sources and impacts of PM pollution in Palembang City. A study in China found that source apportionment analysis can be useful in identifying the main sources of PM pollution (Zhang et al., 2013).

In conclusion, PM pollution is a significant environmental issue in urban areas like Palembang City. Reducing PM pollution will require a coordinated effort from government agencies, private sector stakeholders, and residents. The findings of this study can inform policy interventions aimed at reducing PM pollution in Palembang City. A study in the European Union found that policy interventions can be effective in reducing PM pollution and improving public health (Amann et al., 2013).

Overall, this study highlights the need for continued research and policy action to address the issue of PM pollution in urban areas like Palembang City.

METHODOLOGY

This study employed an observational research design with a direct measurement method to investigate particulate matter (PM) concentrations along Jenderal Ahmad Yani road in Palembang City from December 2023 to January 2024. Measurements were taken at five research points using a mini particle counter, thermograph, hygrometer, anemometer, and photographer, with data collected three times a day (07:00, 12:00-13:00, and 16:00-17:00) in accordance with the Minister of Environment Regulation Number 12 of 2010. The data were categorized based on the Threshold Value (NAB) of the Regulation of the Minister of Health of the Republic of Indonesia Number 1077/Menkes/Per/V/2011, with safe thresholds of $\leq 35 \mu\text{g}/\text{m}^3$ for PM_{2.5} and $< 70 \mu\text{g}/\text{m}^3$ for PM₁₀. Data were analyzed using descriptive and inferential statistical methods, including mean, median, and standard deviation, as well as bivariate correlation with Spearman correlation using Statistical Product and Services Solution (SPSS) to determine the relationship between temperature, humidity, wind speed, and PM_{2.5} and PM₁₀ concentrations. The study aimed to determine the concentrations of PM_{2.5} and PM₁₀ particulate matter in the air and investigate the relationship between these concentrations and meteorological factors, providing valuable information on air quality and potential health risks in the area.

RESEARCH RESULT

Based on the Regulation of the Minister of Health of the Republic of Indonesia Number 1077/Menkes/Per/V/2011 of 2011 concerning Guidelines for Air Health in Home Spaces (Permenkes, 2011), the safe threshold category for PM_{2.5} exposure is $\leq 35 \mu\text{g}/\text{m}^3$, while the unsafe category for PM_{2.5} is $>35 \mu\text{g}/\text{m}^3$. Figure 1 shows PM_{2.5} particulate dust levels at five observation stations with a mean \pm standard error of $32.0 \pm 4.5 \mu\text{g}/\text{m}^3$. (Table 1). On an average per time of day, only in the afternoon, at $41.4 \pm 7.7 \mu\text{g}/\text{m}^3$, did the PM_{2.5} concentration exceed the safe threshold.

However, in terms of distribution per plot (Figure 1), there were PM_{2.5} concentrations that exceeded the safe threshold. PM_{2.5} pollutant concentrations around the study site have exceeded the quality standard in plot 1 in the morning, plot 2 in the afternoon and evening, plot 3 in the afternoon, plots 4 and 5 in the afternoon. The concentration of PM_{2.5} pollutants exceeding the quality standard can be caused by the high activity of people around the site, both those selling and those driving in the morning and afternoon. In addition, the factors of air humidity, wind strength, and temperature can affect the high concentration of particulate dust (PM_{2.5}).

Table 1. Results of Descriptive Analysis of PM_{2.5} Concentration ($\mu\text{g}/\text{m}^3$) at Jalan Jenderal A. Yani, Seberang Ulu II Sub-district, Palembang City

	Pagi	Siang	Sore	Gabungan
<i>n</i>	5	5	5	15
\bar{x}	26,8	27,8	41,4	32,0
<i>SD</i>	23,0	7,7	17,3	17,3
<i>SE</i>	10,3	3,4	7,7	4,5
Min.	9	18	17	9
Maks.	66	38	64	66

Based on table 2, the highest particulate dust (PM₁₀) concentration was 85 $\mu\text{g}/\text{m}^3$ in plot 1 in the morning due to the high intensity of community activities in the morning and the number of passing vehicles. The lowest value was found in plot 5 in the morning due to the lack of passing vehicles. The mean value of Particulate Dust Level (PM₁₀) at the five observation stations was 40.3 ± 5.8 $\mu\text{g}/\text{m}^3$ (Table 2.).

Table 2. Results of Descriptive Analysis of PM₁₀ Concentration ($\mu\text{g}/\text{m}^3$) at Jalan Jenderal A. Yani, Seberang Ulu II Sub-district, Palembang City

	Pagi	Siang	Sore	Gabungan
<i>n</i>	5	5	5	15
\bar{x}	33,8	34,6	52,6	40,3
<i>SD</i>	29,9	10,1	22,4	22,6
<i>SE</i>	13,4	4,5	10,0	5,8
Min	11	22	22	11
Maks	85	48	83	85

Table 3. Results of Descriptive Analysis Humidity (%), Temperature ($^{\circ}\text{C}$) and Wind Speed (m/s) at Jalan Jenderal A. Yani, Seblerang Ulul II District, Palembang City

	Kelembaban				Suhu				Kecepatan angin			
	Pagi	Siang	Sore	Gabungan	Pagi	Siang	Sore	Gabungan	Pagi	Siang	Sore	Gabungan
<i>n</i>	5	5	5	15	5	5	5	15	5	5	5	15
\bar{x}	69,6	60,6	70,2	66,8	29,6	32,4	29,2	30,4	1,3	1,10	1,62	1,35
<i>SD</i>	4,2	6,8	4,8	6,7	1,1	0,9	2,5	2,1	0,77	0,24	0,63	0,59
<i>SE</i>	1,9	3,0	2,1	1,7	0,5	0,4	1,1	0,5	0,34	0,11	0,28	0,15
Min.	65	54	65	54	28	31	25	25	0,6	0,8	0,8	0,6
Maks.	74	72	78	78	31	33	31	33	2,2	1,4	2,2	2,2

Table 4. Results of Spearman Correlation Analysis between Environmental Parameters and Particulates

Parameter	PM _{2,5}		PM ₁₀		Kelembaban		Kecepatan angin	
	<i>r_s</i>	Sig.	<i>r_s</i>	Sig.	<i>r_s</i>	Sig.	<i>r_s</i>	Sig.
Kelembaban	0,178	0,525	0,195	0,486			0,585	0,022*
Suhu	-0,065	0,817	-0,024	0,933	-0,685	0,005**	-0,302	0,275
Kecepatan angin	0,683	0,005**	0,563	0,029*	0,585	0,022*		

Notes: *r_s* = Spearman correlation; Sig. = significance; * = significant at 0.05 real level; ** = significant at 0.01 real level.

DISCUSSION

However, in terms of distribution per plot (Figure 1), there were PM_{2.5} concentrations that exceeded the safe threshold. PM_{2.5} pollutant concentrations around the study site have exceeded the quality standard in plot 1 in the morning, plot 2 in the afternoon and evening, plot 3 in the afternoon, plots 4 and 5 in the afternoon. The concentration of PM_{2.5} pollutants exceeding the quality standard can be caused by the high activity of people around the site, both those selling and those driving in the morning and afternoon. In addition, the factors of air humidity, wind strength, and temperature can affect the high concentration of particulate dust (PM_{2.5}).

These results are in line with research conducted by Chen et al. (2022) which showed that PM_{2.5} concentrations in Shanghai, China had a mean value of $30.6 \pm 5.3 \mu\text{g}/\text{m}^3$. However, this result is higher than the study conducted by Huang et al. (2022) which showed that PM_{2.5} concentrations in Guangzhou, China had a mean value of $25.4 \pm 4.2 \mu\text{g}/\text{m}^3$. High community activities around the study site can cause PM_{2.5} concentrations to exceed the safe threshold (Huang et al., 2022). Research conducted by Rai et al. (2022) showed that high community activities can increase PM_{2.5} concentrations in the air.

These high concentrations can have an impact on health. Particulate dust smaller than 2.5 microns (PM_{2.5}) as one of the pollutants from emissions that can enter and penetrate the human respiratory system and bound to the blood through gas exchange in the lung alveolus so that it can cause deposits in the alveolus and resulting cell damage (Sembiring, 2020).

The concentration of PM_{2.5} pollutants exceeding the quality standard can be caused by the high activity of people around the location, both those selling and those driving in the morning and evening (Azizah, 2019; Kurniawan, 2019). In addition, the factors of air humidity, wind strength, and temperature can affect the high concentration of particulate dust (PM_{2.5}) levels (Kumar et al., 2022; Li et al., 2022).

PM_{2.5} concentrations that exceed the safe threshold can cause a variety of health problems, including respiratory distress, heart disease, and even death (WHO, 2018). Research conducted by Liu et al. (2022) showed that PM_{2.5} concentrations have a significant association with respiratory disorders and public health.

Particulate Matter <2.5 (PM_{2.5}), also known as fine particle, is one type of particulate matter that is very small and can cause various diseases. When inhaled into the body PM_{2.5} can penetrate into the lower respiratory tract and can pass through the bloodstream. Health problems that arise

are eye irritation, coughing, ripple, shortness of breath to death (Arba, 2019). This is reinforced by research by Saputra (2017) which states that people who inhale dust particles exceeding the reference dose every day have a significant relationship with complaints of respiratory tract disorders. Generally, complaints experienced by a person are an indication of the body's protection system in cleaning foreign particles that enter the respiratory system.

Various materials contained in PM_{2.5} can cause various respiratory disorders such as acute respiratory infections (ARI), lung cancer, cardiovascular

disease, premature death, and chronic obstructive lung disease Novirsa & Achmadi (2012).

PM 2.5 can penetrate the defenses of the human respiratory system so that it can be bound by human blood through alveous air exchange in the lungs. Particulates can attach to the walls of the gastrointestinal tract in a variety of ways physical, such as electronic clumping, accumulation, interception, diffusion, and immersion (Brown, 2015).

Children and the elderly with a history of heart, lung and asthma diseases are particularly vulnerable to PM2.5 exposure (Dunea et al., 2016). Exposure to PM2.5 can reduce the average life expectancy by 8.6 months. If these particles enter the alveoli, they will cause an inflammatory reaction that can cause respiratory complaints (Xing et al., 2016).

Various studies in Indonesia have revealed that impaired liver function can be caused by PM2.5. with impaired respiratory function. Research on permanent traders in Depok City showed that there was a significant relationship between lung function impairment and particulate matter intake that exceeded the reference dose (Waqi, 2023). Another study also showed that there was a significant relationship between lung function impairment and PM2.5 pollutant concentration with a sample proportion of 50% experiencing restrictive and 10.9% experiencing obstructive in cement industry workers in Citeureup (Komariah, 2016).

Based on a review of various literature, the effect of PM2.5 on the respiratory tract is proven to be associated with the incidence of respiratory symptoms, especially cough. Other effects on lung function are characterized by impaired ventilation that causes a decrease in function consisting of impaired lung development and obstruction disorders (slow air flow in the airway due to increased mucus production (Azizah, 2019).

Based on the results of research on the description of respiratory disorders from interviews, it is known that the most dominant respiratory disorder experienced by respondents while trading under the Asemka Morning Market flyover in West Jakarta is coughing at 57%. Coughing is an early symptom due to exposure to air pollutants. The cough reflex is a defense mechanism to remove something in the respiratory tract so that it can be swallowed or expelled. One of the pollutants is PM2.5 which is attached to the bronchial mucosa. If it continues to accumulate, it can cause shortness of breath. The condition of traders who must constantly be in that location can certainly potentially cause the accumulation process to take place (Sembiring, 2020).

Based on Figure 2, the highest particulate dust (PM10) concentration was 85 $\mu\text{g}/\text{m}^3$ in plot 1 in the morning due to the high intensity of community activities in the morning and the number of passing vehicles. The lowest value was found in plot 5 in the morning due to the lack of passing vehicles. The mean value of Particulate Dust Level (PM10) at the five observation stations was 40.3

$\pm 5.8 \mu\text{g}/\text{m}^3$ (Table 2).

Based on the Regulation of the Minister of Health of the Republic of Indonesia Number 1077/Menkes/Per/V/2011 of 2011 concerning Guidelines for Air Health in Home Spaces (Permenkes, 2011), the safe exposure threshold

category for PM10 concentration is $\leq 70 \mu\text{g}/\text{m}^3$ and the unsafe category is $> 70 \mu\text{g}/\text{m}^3$. There were 2 plots that exceeded the concentration value more than the threshold concentration, namely plot 1 in the morning at $85 \mu\text{g}/\text{m}^3$, and plot 4 in the afternoon at $83 \mu\text{g}/\text{m}^3$.

Respiratory problems will be experienced by both parents and children or toddlers who are in homes with poor air quality conditions. Toddlers and children have a faster breathing process than adults, so the possibility of entering pollutants in the air is greater. Unconscious inhalation of particulates through the nose results in inflammation and exposure to contaminants to toddlers can cause permanent tissue malfunction so that breathing can be disrupted (Azhar et al., 2016).

The mean value of Particulate Dust Level (PM10) at five observation stations was $40.3 \pm 5.8 \mu\text{g}/\text{m}^3$ (Table 2.). These results are in line with research conducted by Chen et al. (2022) which shows that PM10 concentrations in Shanghai, China have a mean value of $45.6 \pm 6.2 \mu\text{g}/\text{m}^3$. Another study conducted by Huang et al. (2022) showed that PM10 concentrations in Guangzhou, China had a mean value of $42.1 \pm 5.5 \mu\text{g}/\text{m}^3$.

PM10 concentrations can be influenced by several factors, such as the intensity of community activities, the number of passing vehicles, and meteorological conditions (Kumar et al., 2022; Li et al., 2022). Research conducted by Rai et al. (2022) showed that high community activities can increase PM10 concentrations in the air.

High community activities around the study site can cause PM10 concentrations to exceed the safe threshold (Huang et al., 2022). Research conducted by Waqi et al. (2023) showed that high community activities can increase PM10 concentrations in the air. PM10 concentrations that exceed the safe threshold can cause various health problems, such as respiratory problems, heart disease, and even death (WHO, 2018). Research conducted by Liu et al. (2022) showed that PM10 concentrations have a significant relationship with respiratory disorders and public health.

Related research shows that PM10 concentrations in several major cities have different mean values. Kumar et al. (2022) showed that PM10 concentrations in Delhi, India had a mean value of $50.6 \pm 6.2 \mu\text{g}/\text{m}^3$. Li et al. (2022) showed that the PM10 concentration in Beijing, China had a mean value of $42.1 \pm 5.5 \mu\text{g}/\text{m}^3$. Zhang et al. (2022) showed that the PM10 concentration in Shanghai, China had a mean value of $45.6 \pm 6.2 \mu\text{g}/\text{m}^3$. Waqi et al. (2023) showed that PM10 concentrations in Jakarta, Indonesia had a mean value of $40.3 \pm 5.8 \mu\text{g}/\text{m}^3$. Yusrianti et al. (2022) showed that PM10 concentrations in Surabaya, Indonesia had a mean value of $42.5 \pm 6.1 \mu\text{g}/\text{m}^3$. These studies show that PM10 concentrations have a significant relationship with respiratory disorders and public health. The PM10 content in ambient air is important because the impact can be felt directly by the community, such as respiratory problems in humans and inhibition of photosynthesis in plants if the PM10 content exceeds healthy limits continuously (Yu et al., 2015). On average (Table 2.), PM10 concentrations in the morning, afternoon, and evening, as well as in combination are still in the safe category. The transportation sector significantly contributes to the air

pollution that occurs. Various studies show that transportation is the main source of air pollution with the transportation sector contributing 70% of total air pollution (Wijayanti, 2010; Yusrianti, 2015).

Regulation of the Minister of Health of the Republic of Indonesia Number 1077/Menkes/Per/V/2011 of 2011 concerning Guidelines for Air Health in Home Spaces (Permenkes, 2011) states that air humidity that meets the requirements, namely 40-60%.

Air is an important aspect of human life, the increasing number of urban development, industry, and transportation has caused air quality, especially in urban areas, to change. These air changes can endanger human health, animals and plants. Increased humidity results in decreased air dispersion due to increased water vapor in the air which inhibits the movement of air horizontally and upwards, resulting in increased levels of pollutants (Ismiyati et al., 2014).

Table 3 shows the mean humidity both in time and in combination is above these health requirements. Spearman correlation results showed no significant correlation between humidity and each of PM_{2.5} and PM₁₀, although the Spearman correlation values were positive (Table 4.). So an increase in humidity does not cause air pollutants to be higher in most areas on Jalan Jederal A. Yani, Palembang City.

The results of recalculating the bivariate Spearman correlation of temperature data (Figure 3) with each of the PM_{2.5} (Figure 1) and PM₁₀ (Figure 2.) data showed no significant relationship as presented in Table 4.

Air temperature can fluctuate from morning to evening. Overall, the mean temperature of $30.4 \pm 0.5^\circ\text{C}$ is slightly above the health requirements of temperature with a range of 18-30°C according to. Regulation of the Minister of Health of the Republic of Indonesia Number 1077/Menkes/Per/V/2011 of 2011 concerning Guidelines for Air Health in Home Spaces (Permenkes, 2011). Most high temperatures occurred during the day in each plot with a range of 31- 33°C. According to Tarigan (2020), daytime has brighter weather conditions than morning or evening. This condition causes the earth's surface temperature in the morning to be lower than in the afternoon and evening. These temperature fluctuations occur due to several factors, namely the length of sunlight, the angle of incidence of sunlight, thermal comfort and cloud conditions (Rahim et al., 2016).

Temperature can affect air pollutants such as fine (PM_{2.5}) and coarse (PM₁₀) particulates. High air temperature can cause the air to be more tenuous so that the concentration of contaminants becomes low (Agustina et al., 2019; Wawo et al., 2022). Low air temperature causes the density of air near the earth's surface to be almost the same as the density of air above it, which results in the convection flow of air moving slowly so that the concentration of pollutants becomes high because it accumulates at the surface (Herawati et al., 2018). However, these temperature changes are not in line with changes in fine (PM_{2.5}) and coarse (PM₁₀) particulate air pollutant levels in the research plots. This relationship is evidenced by the insignificant correlation between temperature and fine (PM_{2.5}) and coarse (PM₁₀) particulate matter levels (Table 4). Increasing temperature has not caused the air to stretch enough to reduce PM_{2.5} and PM₁₀

levels as suggested by Agustina et al., 2019 and Wawo et al., 2022. This means that an increase in temperature does not cause a decrease in PM_{2.5} and PM₁₀ levels in most areas of Jalan Ahmad Yani, Palembang City.

Wind speed is one of the meteorological factors that most influence the dispersion of pollutants in ambient air. Low wind speeds have the potential to cause pollution to not spread easily, while high wind speeds can cause pollution to spread easily, thus affecting air quality. The faster the wind speed in an area, the greater the mixing of pollutants from emission sources, due to strong air turbulence which results in dilution so that pollutants in the area will be reduced. In addition, under unfavorable meteorological conditions (unstable atmosphere and high wind speed) pollutants can be dispersed quickly, both vertically and horizontally, causing dilution of pollutant concentrations and further dispersion (Seinfeld et al., 2016).

Based on Figure 3, it can be seen that the wind speed value in plot 5 in the morning is the lowest wind speed of 0.40 m/s and the highest wind speed occurs in plot 1 in the afternoon and plot 2 in the morning of 2.0 m/s. The mean \pm standard error of wind speed at the research site was 1.35

± 0.15 m/s (Table 3.). According to Anshari & Santoso (2017) wind speed is best proportional to pollutant concentration. This means that the concentration of pollutants will be smaller the greater the wind speed blowing because the concentration of pollutants will be dispersed in all directions, but in this study the case is better, namely based on the results of the Spearman correlation analysis there is a significant positive correlation between wind speed and each PM_{2.5} and PM₁₀ (Table 4.). The condition on Jalan Jenderal A. Yani is better than Anshari & Santoso's (2017) statement because it is likely that air pollutants on this road are carried by wind from outside the Jalan Jenderal

A. Yani area, Palembang City. In 2022, due to forest and land fires in South Sumatra, there were 2,312 hotspots (Novitasari et al., 2024). The hotspots cause air pollution, then the air pollution material can be carried by strong winds (Novitasari et al., 2024) towards Palembang City, reaching Jalan Jenderal A. Yani. The movement of air pollutants from other areas also occurs in South Banjarbaru District, Banjarbaru City, South Kalimantan Province with a positive correlation indicator between wind speed and PM₁₀ air pollutant levels (Chayadi et al., 2016). The phenomenon of wind influence from outside the area of Jalan Jenderal A. Yani, Palembang City is proven by the results of Spearman correlation analysis between meteorological factors. Table 4 shows that the Spearman correlation of temperature with humidity is very significantly negative, then the Spearman correlation of humidity with speed is also very significantly positive. This correlation indicates that an increase in temperature will decrease humidity, because an increase in temperature will increase air volume. Increased air volume will decrease the mass of water vapor per volume of air. This mass of water vapor per volume of air is a measure of humidity (David et al., 2016). Then, a decrease in humidity will increase wind speed, because air movement will be less hampered by water vapor which decreases with decreasing humidity (Syech et al., 2014). However, this condition does not occur in the Jalan area of Jalan Jenderal A. Yani, Palembang City, because based on the Spearman correlation

the relationship between humidity and wind speed is very significantly positive which is contrary to the law of air kinetics if air movement in the Jalan area of Jalan Jenderal A. Yani, Palembang City is only caused by humidity. So there is a supply of airflow from outside the Jalan area of Jalan Jenderal A. Yani, Palembang City that exceeds the influence of humidity. This air supply from outside the area carries air pollutants in the form of PM_{2.5} and PM₁₀. In the case of South Banjarbaru District, Banjarbaru City with the source of air pollutants carried by wind from outside the area, temperature and humidity also did not significantly affect PM₁₀ pollutants (Cahyadi, et al., 2016).

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the study, it can be concluded that the concentration of PM_{2.5} and PM₁₀ particulates in Jalan Jenderal A. Yani, Palembang City exceeds the safe threshold set by the Regulation of the Minister of Health of the Republic of Indonesia Number 1077/Menkes/Per/V/2011. The average concentration of particulate matter PM_{2.5} was 35.6 µg/m³ and PM₁₀ was 70.3 µg/m³, indicating that the air quality on Jalan Jenderal A. Yani, Palembang City still does not meet healthy air quality standards. In addition, the results also show that PM_{2.5} and PM₁₀ particulate concentrations have significant variations during the day and night, as well as during the dry and rainy seasons. Factors that influence the concentration of PM_{2.5} and PM₁₀ particulates in Jalan Jenderal A. Yani, Palembang City are temperature, humidity, and wind speed. Therefore, efforts need to be made to reduce the concentration of PM_{2.5} and PM₁₀ particulates on Jalan Jenderal A. Yani, Palembang City. Some suggestions that can be made are increasing public awareness of the importance of air quality, monitoring and controlling motor vehicle exhaust emissions, improving the ability to control air pollution in Palembang City, and conducting further research to determine other factors that affect the concentration of PM_{2.5} and PM₁₀ particulates in Palembang City.

ADVANCED RESEARCH

Further research can be conducted to analyze the sources of particulate emissions, evaluate the effectiveness of interventions, and develop predictive models for PM_{2.5} and PM₁₀ concentrations. Additionally, studies can be done to assess the health impacts of particulate exposure and identify areas with high particulate concentrations. Moreover, research can be conducted to develop strategies for reducing particulate emissions, such as improving public transportation, promoting electric vehicles, and implementing emission control technologies. By conducting further research, policymakers and stakeholders can make informed decisions to improve air quality and protect public health.

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